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Original scientific paper

ANTHRAX OF DOMESTIC ANIMALS IN VRBAS BANATE: FROM TRADITIONAL BELIEFS TO THE FIRST SCIENTIFIC VIEWS ON THE ANCIENT DISEASE

BEDRENICA KOD DOMAĆIH ŽIVOTINJA U VRBASKOJ BANOVINI: OD NARODNIH VJEROVANJA DO PRVIH ZNANSTVENIH POGLEDA NA DREVNU BOLEST

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Summary

From 1929 to 1941, the Vrbas Banate was one of nine provinces of the Kingdom Yugoslavia, and according to historical data, the poorest one, without well-organized and sustainable agriculture production. Naturalistic production and poor animal health control in the Vrbas Banate were the most important risk factors for infectious disease spreading. Anthrax was very prevalent infectious disease in domestic animals and humans in that period, but some data on this disease remain scarce. In this paper epidemiology and clinical investigation of anthrax in the Vrbas Banate are reviewed. Apart from many aggravating factors

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that influenced the control of anthrax, the veterinary service of Banate contributed to the development of animal husbandry, animal health and public health in that period.

Key words: *anthrax; the Vrbas Banate; control; history of medicine.*

Introduction

Anthrax has been known more than 4000 years. According to the Book of Genesis, it was believed that the anthrax was the cause of the great plagues in Egypt, especially in cattle herds, and because of that, this disease was called "*Egyptian lash*" . Cattle plague was Jewish God's punishment to the Pharaoh, and it was considered to be one of the largest torments to ancient Egyptian people. Anthrax or better said „*disease by descriptions like to anthrax*" called „*sac*" was described in the veterinary papyrus of Kahun. Furthermore, this devastating plague was known in other ancient civilizations such as Assyria, Persia, India, China etc. Thus, data on anthrax and other infectious diseases - plagues, were found in Ashurbanipal's library, in which written documents state that sick animals were isolated from healthy ones or killed and their barns burned (1).

During the rise of veterinary medicine, concerning the antiquity, anthrax was known among farmers and veterinarians. It was known that can be transmited to humans, and therefore was the cause of great fear among the people. Aristotle describes the terrible disease of sheep which was considered to be a anthrax. It was difficult to recognize, but it was typical that the best sheep were affected. This view can be logically linked to the fact, that in sheep non-clinical, peracute form of anthrax was common. In "The Iliad" Homer describes Apollo's curse named "*burning wind of plague*" of dying people and animals, which can be associated with anthrax. Greek physician Hippocrates first used the term "anthrax" which in Greek means "coal", specifying the black ulcers – malignant pustule on the skin of humans and black blood in dead animals.

In ancient Rome anthrax was mentioned by the Roman writer Pubilus Vergilus Maro (71-19 BC) in Georgica. He writes about the plagues that devastated goat and sheep farms in Noricum (2). Sheep that get sick from anthrax lag behind from the herd - "*stretch in the shadow*", often lie and graze poorly. Virgil says that, before the disease is spread across "*innocent*" herd, such "*evil*" should be eradicated with a knife (2). In addition to Virgil, Columella, writer of *De re rustica*, describes ways of eradication several endemic diseases including anthrax.

Due to development of medical and biological sciences more about anthrax can be learned in the Middle Ages. In the 14th century, the term "*anthrax*" was first used in the English literature after Hippocrates and later became a common synonym for disease. The first outbreak of anthrax in humans occurred in 1613 when this disease was called the "*black plague*" or "*black poison*", given that cutaneous form of disease was common. Officially, Maret and Fournier gave the first clinical description of the disease gave in humans, while Chabert described in detail the symptoms in domestic animals. Maret and Fournier concluded that people who had been in contact with animals or leather raw materials from animals got affected. Thus, epidemic pulmonary form of anthrax occurred in 1846 in a leather factory near Bradford when a large number of people were infected with spores of anthrax, which was found in raw wool of sheeps - Woolsorters disease.

As mentioned, French parasitologist Philibert Chabert (*1737* -1814) gave the first description of anthrax in livestock, when he noticed that it is primarily a disease of grazing animals - sheep and oxen. Chabert noted that diseased animals in most cases die suddenly without any symptoms. If the opposite occurs, cattle entering in a phase of unrest or excitation, and then become depressed and finally die. Suden death was common, mucous membranes become hyperemic and hemorrhagic, throat and abdomen swell, while dark blood that hardly coagulates flows from natural body orifices. In 1850, Delaford and Devain found rod-shaped bacteria in the blood from dead cattle and stated doubt on the cause of the disease (3).

However, the biggest discovery is the study of anthrax made by German microbiologist Robert Koch (1843-1910). Description of anthrax bacterium was the key momentum for understanding the real etiology of disease. The French chemist Louis Pasteur continued Koch's research and set the simple steps in pathobiology of infection: *"anthrax bacterium is aerobe and thefore it can reproduce in the blood of animals, leading to asphyxiation of red blood cells*" (4). Guided by his work on fowl cholera, Louis Pasteur designed the first vaccine against anthrax.

After these pioneering results in anthrax understanding, systematic study began, which was the basis for controlling the spead of infection with anthrax bacillus. Today, anthrax rarely appears in veterinary practice, as a result of the modern animal breeding – high biosafety levels, vaccination and control programs. After a review of some recent professional literature, it can be concluded that anthrax is more and more becoming "ancient" with

increasingly historical significance. According to Čavaljuga (5) 20 animal cases of anthrax in Bosnia and Herzegovina (BiH) were reported from 2001 to 2010. Same author claims that the data on this "classic" zonosis indicate that it occurs sporadically and apparently has no importance.

The aim of this paper is to review data on traditional beliefs about anthrax with emphasis on epidemiological and clinical characteristics of anthrax in Vrbas Banate (1929-1941) after the first veterinary laboratories and veterinary administrative authorities in Banja Luka, BiH, were formed.

Basic traditional beliefs about anthrax in local human population

Generally, term for anthrax, used by all Western Balkan nations can translate as "*bedrenica*". According to folk beliefs, "*bedrenica*" or anthrax is cattle disease that can destroy entire herds, and it is called "*bedrenica*" because of typical signs that appears on the thights of livestock (6). Literal meaning of "*bedrenica*" is "*disease of thighs*". Depending on the region of BiH, there are certain differences in belief regarding the disease. In Herzegovina, the disease is called „*travnjača*" or „*bljuzgavac*" and according to tradition, animals can hardly survive after the disease was identified (7). Other terms for disease is "*slezena*" or "*slezina*", because of heavy pathological changes on spleen, which can be recorded after *post mortem* examination. According to tradition, animals which have mentioned condition „*slezena*" or „*slezina*" must be cuted betwen ribs to prevent spleen rupture. Klajić (8) mentions the following synonyms for anthrax in Croatia: *černi čir, poganac, prikojas, zlić, zlikovac, karbunkulus, furunkulus* and *antraks*. In Serbian language the following terms are used: *antraks, crni prišt, zlić, krepać, prostrel, nepomenik, travnjak* and *bedrenica* (9). In Vojvodina anthrax is known as: *perzijska groznica, barska groznica, zaraza slezine, černe ospice, letnja groznica* and *kuga* (10). Some country population have resorted to the belief of sheep re-shearing (Serbian: *„prestrižavanje"*) which can be seen especially among the Serbs from the Prokletije Mountains. If cutaneous anthrax occurs in sheep and cattle, it is necessary to squirm and lubricate ulcers (carbunculus) with oil and garlic extract until the abscess bursts (7).

Some traditional beliefs were included in research papers of the pioneer veterinarians in Vrbas Banate. For intance, Dr Petar Trumić noted that dead sheep on mountain pastures were often subject of curiosity of young shepherds. They would open carcasses of dead sheep and possibly contaminate

the pasture with spores of anthrax bacillus. If shepherds saw the abnormal spleen enlargement they used to say: „ *It is not carbunculus, it is "slezena*" (11). Therefore, there was not possibility for them to distinguish anthrax clinical forms. In Bosnian Muslims - Bosniaks, the most important way to cure anthrax in domestic animals was witchcraft and sorcery. In recent study from Šubarević et al. (12) about veterinary ethnomedicine on Stara Planina Mount, it was found that that the present method of anthrax treatment was sorcery and "bleeding" of animals.

Ethnologist Višekruna (7) desribes etnoveterinary medicine in Podveležje – Herzegovina. This author conclude tha sorcery only helps while "carbuncle" is red and swollen, and when process becomes chronic therapy was not possible. According to Vuković (13), the official Turkish military veterinarians or „bajtars" did not fully implemented the measures of modern veterinary medicine, so that there is a high probability that they used and accepted traditional methods to cure infectious diseases in Bosnia. It is widely known, that over many centuries under Turkish occupation, the indigenous population in BiH received Ottoman customs and traditions, including the ways of treating animal diseases.

Modern veterinary service in Bosnia and Herzegovina and new view on anthrax

Veterinary practice and development of veterinary personnel is closely linked to the Austro-Hungarian occupation of BiH in 1878. According to Džaja et al. (14), in 1880 Bosnia had only ten civilian veterinarians, and therefore many outbreaks of infectious diseases, including anthrax, were recorded. In the late 19th century in BiH, the focus was given to the following two infectious animal diseases: cattle plague that has successfully eradicated in 1883 (last outbreak was in Bijeljina district) and glanders or "worm" in horses.

Officially, anthrax was among especially dangerous diseases in BiH at that time. The Decree on eradication of especially dangerous diseases – bovine plague, pneumonic disease etc. greatly contributed to combat against the disease (13). Under the Austro-Hungarian Empire in BiH, at the end of the 19th century, the first veterinary stations were founded, some of which were built on the territory of later Vrbas Banate – for example the Veterinary Clinic in Dubica.

Obviously, at the time, the occurrence of anthrax was related to lowland and commonly flooded areas. The data on anthrax outbreaks in Bosnia

before the First World War remain incomplete, unlike in Croatia, where precise data indicate devastating effects of anthrax in the late 19th century (1). Until 1900s, all dangerous livestock diseases were brought under control, including anthrax (15). Although, according to the authors, this fact should be taken with reserve, which will be explained later in the case of monitoring the epidemiological situation in Vrbas Banate.

Specifically, the term "control" at a given time must be accepted more flexible. There are many reasons for this interpretation: a large number of cattle and the lack of disease surveillance, a small number of veterinarians, extensive and naturalistic animal husbandry, poor enlightenment of the population of cattle diseases, lack of specialized veterinary laboratories to set up the final diagnosis. Anthrax at that time was hard to differentiate from other septicemic diseases and clostridial infections. Implementation of the legal framework led to reduction of anthrax cases and outbreaks, but after the fall of Austro-Hungarian Monarchy and the First World War, general socio-economic changes occurred in BiH. All these factors were critical to veterinary service weakness, reduction in number of domestic animals in Bosnia and new disease outbreaks. After the formation of the Kingdom of Yugoslavia, the revival of agriculture and animal husbandry took place.

However, there are detailed epidemiological data on the occurrence of anthrax in the period 1924 – 1928. According to Debelić (16), anthrax was the most common disease in the period, but never received epidemic proportions, as was the case with swine fever for example. If we observe the occurrence of anthrax statistically, it can be noted that the number of anthrax-affected districts in the Kingdom of Yugoslavia rose in the period 1924 – 1928, from 47.2% to 58.1%, respectively. In the Vrbas area (later Vrbas Banate) in 1924, anthrax was reported in seven counties, in 1925 in six counties, in 1926 in four counties, in 1927 in 7 counties and in late 1928 in six counties. In the period from 1925 to 1928 in the Kingdom of Yugoslavia, 2,703 cases of human anthrax were reported, 355 of which had lethal outcome. In the Vrbas area, 61 human cases were recorded in the given period, ten of which with lethal outcome. In comparison to other regions in the Kingdom, in Vrbas area anthrax had the lowest prevalence in domestic animals.

Vrbas Banate (Figure 1.) was one of nine provinces of the Kingdom of Yugoslavia with its administrative center in Banja Luka from 1929 to 1941. Since 1929, there were official statistical data of social importance for the Kingdom; hence, it is possible to find relevant local information on livestock

and agriculture situation in the whole Banate for this period. The arrival of Svetislav Tisa Milosavljević in Banja Luka brought progress to the Vrbas Banate, reflected in the development of veterinary service and agriculture in general. Veterinary service in Vrbas Banate experienced major progress with the establishment of the Department for Epidemiology at the Institute of Hygiene in Banja Luka in 1934. From this point, new diagnostic capacities and a new epidemiological approach, the control of infectious diseases in Vrbas Banate was raised to a higher level.

Figure 1. Map of Vrbas Banate in Yugoslavia 1929-1939

Epidemiology and clinical investigation of anthrax in Vrbas Banate

Anthrax was a very common subject of investigation in Croatia, which is understandable owing to the already established Faculty of Veterinary Medicine in Zagreb. Pioneer research on anthrax and *Bacillus anthracis* in Vrbas Banate and BiH was made by Banate veterinarian Dr Petar Trumić (later Head of Veterinary Service in Vrbas Banate and founder of the Department of Infectious Diseases at the Faculty of Veterinary Medicine University of Belgrade) and Dr Vaso Butozan, Head of Department of Epidemiology at the Institute of Hygiene. The biography of Dr Vaso Butozan and his role in the development of veterinary medicine in Bosnia was described in detail by Stevanović et al. (17). On the other hand, Dr Petar Trumić was born in Gradiška, finished the veterinary school in Vienna, and from the beginning of his career was very familiar with the problems related to diagnostics of anthrax in cattle and sheep. In 1937, Dr Trumić wrote an important article entitled "Knowledge and control of anthrax". This paper reviews epidemiology

and clinical description of this disease in domestic animals in Vrbas Banate. According to Trumić (11), "bedrenica" or anthrax is the disease of concern to Vrbas Banate legislation, but primary problem remains accurate diagnosis by county field veterinarians. At the time, the so-called "atypical forms" of anthrax were known, which clinically differed from those described in the available fundamental literature of that time.

In the detailed description of clinical picture by Trumić (11), it can be seen that anthrax occurred mostly in cattle, where possible misdiagnosis with "*angina*" and clostridial oedema was made. In its subacute clinical form, "throat edema" occurs, which is mostly soft and cold on palpation. In some cows, this edema can protrude to form serious wounds on the neck region. In some cases, there are no signs of infection – cows are afebrile, the pulse is normal, and there is no accelerated and heavy breathing. In most such cases muscle tremors and lameness of hind limbs were recorded, which can be pathognomonic for anthrax (11).

There is no doubt that, on many occasions, the veterinarians approached to the empirical therapy. The primary control measures of anthrax in Vrbas Banate were vaccination and application of serum to the affected animals. However, Trumić (11) reported one case of anthrax in a vaccinated cow.

In sheep, anthrax is even more difficult to recognize, and treatment is always unsuccessful. In diseased sheep, the most common sign is hematuria and blood in feces can be noticed before the animal dies. Such sheep are lagging behind the flock, lying on pasture and they finally die in agony. Sudden death syndrome in sheep in older literature is referred as "epileptiform" clinical signs that can be linked to clostridial infections – enterotoxaemia, acute distomatosis, listeriosis etc.

All anthrax cases of domestic animals from 1932 to 1937 in Banja Luka county are presented in Table 1 (11).

Table 1. Anthrax cases in Banja Luka county according to Trumić (11)

Village	Date	Affected	Died
1. Višići	04. 06.1932	2 cattle	2 cattle
2. Prijakovci	10. 08. 1932	3 cattle	2 cattle
3. Piskavica	08.08 1932	2 cattle	2 cattle
4. Dobrnja	14. 08. 1932	8 cattle	7 cattle
5. Vukolići-Dobrnja	22. 08. 1932	3 cattle	2 cattle
6. Dović - Manojlovići	16.03. 1933	3 cattle	3 cattle

Village	Date	Affected	Died
7. Vilusi	21.08. 1933	7 cattle 20 sheep 8 goats	5 cattle 17 sheep 8 goats
8. Čokori	06. 11. 1933	4 swine	4 swine
9. Pervan	18. 11. 1934	38 sheep	36 sheep
10. Lusići	26. 08. 1934	5 cattle	5 cattle
11. Bistrica	01. 11.1934	3 cattle	3 cattle
12. Aleksandrovica	21.03. 1935	1 cattle	1 cattle
13. Bistrica	06. 06. 1935	7 cattle 1 horse 3 sheep	2 cattle 1 horse 3 sheep
14. Trninici	26.07. 1935	28 cattle	26 cattle
15. Bistrica	27. 07. 1935	3 cattle 1 sheep	3 cattle 1 sheep
16. Borkovići	19. 08. 1935	9 sheep	9 sheep
17. Dobrnja	10. 09. 1935	4 cattle 16 sheep	4 cattle 16 sheep
18. Radosavska-Vukojlovići-Tolmiri-Krpelji	18. 08. 1935	10 cattle 5 sheep	10 cattle 5 sheep
19. Delibašino selo	06. 08.1935	1 cattle	1 cattle
20. Pervan	04. 091935	10 sheep	10 sheep
21. Lusići	11. 08. 1935	6 cattle 25 sheep	6 cattle 25 sheep
22. Vilusi	02.10 1935	5 sheep	5 sheep
23. Lusići-Mitrovići	23. 10. 1935	5 cattle	5 cattle
24. Pervan – Vukelići	24. 10. 1935	15 sheep	15 sheep
25. Slivanj-Zec-Milošević	06. 11. 1935	1 horse 1 cattle 10 sheep	1 horse 1 cattle 10 sheep
26. Gornji Pervan - Vukelići	24. 01.1936	5 sheep	5 sheep
27. Radmanići	22. 04.1936	20 sheep	20 sheep
28. Radosavska-Vukojlovići-Tolmiri-Krpelji	27. 07. 1936	4 cattle	4 cattle
29. Laktaši	29. 07.1936	5 cattle	5 cattle

Village	Date	Affected	Died
30. Bronzani Majdan, Klipići	22. 08.1936	4 cattle 1 horse 8 sheep	3 cattle 1 horse 8 sheep
31. Dujakovci, Vulini, Radovanovići	13. 08.1936	123 sheep	123 sheep
32. Sljivanj, Antonići	17. 08.1936	8 sheep	8 sheep
33. Piskavica, Buzadžije	19. 08. 1936	7 cattle 4 sheep 12 goat	4 cattle 4 sheep 12 goat
34. Kola, Džajići, Milokovići	03. 08. 1936	3 cattle 2 horses 23 sheep	3 cattle 2 horses 23 sheep
35. Stričići, Pejići, Đurđevići	09. 08. 1936	3 cattle 2 horses 23 sheep	3 cattle 2 horses 23 sheep
36. Petrićevac	13. 10.1936	2 cattle	2 cattle
37. Bastasi, Kostići	17. 10.1936	4 cattle 1 sheep	3 cattle 1 sheep
38. Stričići, Đukići	19.10. 1936	18 sheep	10 sheep
39. Pavići, Šipke	28. 10.1936	4 cattle 7 sheep	4 cattle 7 sheep
40. Vujnovići	16. 12. 1936.	1 cattle	1 cattle

Generally, vaccination was well accepted by farmers and villagers of the Banate, but some adverse effects of vaccination were recorded. In one case from Bosanski Petrovac, a large number of sheep death cases were seen from anthrax after vaccination against sheep pox. In late 19th century, in the region of Vrbas Banate active eradication (cull strategies) of rinderpest and classical swine fever was conducted. Since that time, villagers remained afraid of the veterinarians, because no one easily accepted radical measures to combat the disease. Although the fees were paid, population was impoverished. The same can be said for anthrax, before the implementation of vaccination program, the approach of farmers from Vrbas Banate to eradication of diseased livestock was not acceptable. Education of villagers on the danger for human health that came from anthrax facilitated the work of veterinarians in the Banate.

According to some data, in the territory of the Banja Luka from 1934 to 1936, from anthrax died seven people, while 55 people were affected (11). Although we must take into account that many cases probably were not reported.

Table 2 presents all cases of anthrax in the Vrbas Banate according to reports from county veterinarians.

Table 2. Anthrax cases in the Vrbas Banate from 1929 to 1937

County	Date	Affected	Died	Vaccination	Cured
Sanski Most (18)	01. 01.1929	3 horses	3 horses	/	/
Derventa (19)	02.1.1929	2 cattle	2 cattle	8 horses 95 cattle	/
Bosanska Gradiška (20)	04.02.1929	3 horses 3 cattle	3 horses 3 cattle	/	/
Prnjavor (21)	04.01.1930	20 cattle	20 cattle	/	/
Gračanica (22)	04.01.1930	3 cattle	3 cattle	/	/
Maglaj (23)	10.01.1930	3 horses 8 cattle	1 horse 6 cattle	60 horses 280 cattle 80 sheep	2 horses 2 cattle
Ključ (24)	19.01.1930	2 horses 24 cattle 1 sheep 5 goats	2 horses 24 cattle 1 sheep 5 goats	15 horses 100 cattle 36 sheep 37 goats	/
Gradačac (25)	19.01.1930	3 horses	0	700 horses332 cattle	3 horses
Drvar (26)	30.01.1930	Present	All affected	Conducted	/
Cazin (27)	19.02.1930	4 horses 7 cattle	4 horses 7 cattle	/	/
Bihać (28)	20.02.1930	3 horses 13 cattle	3 horses 13 cattle	/	/
Mrkonjić Grad (29)	27.02.1930	4 cattle	4 cattle	15 cattle 63 sheep	/
Sanski Most (30)	01.03.1930	3 horses 2 cattle	0	41 horses 58 cattle	3 horses 2 cattle
Prijedor (31)	19.03.1930	5 cattle	3 cattle	19 horses 120 cattle	2 cattle
Doboj (32)	21.03.1930	10 cattle	6 cattle	43 horses 304 cattle 160 sheep and goats	4 cattle
Jajce (33)	27.03.1930	6 cattle 10 sheep 4 goats	6 cattle 10 sheep 4 goats	0	0
Banja Luka (34)	05.04.1930	8 horses 10 cattle	5 horses 10 cattle	/	3 horses
Bosanska Dubica (35)	10.01.1931	/	/	182 horses 392 horses 13 sheep	2 horses

County	Date	Affected	Died	Vaccination	Cured
Bosanska Krupa (36)	22.01.1931.	/	0	/	0
Mrkonjić Grad (37)	26.01.1931.	3 cattle	3 cattle	3 horses 6 cattle 70 sheep	0
Prijedor (38)	31.01.1931	6 cattle	0	/	6 cattle
Cazin (39)	31.01.1931	1 horse 3 cattle	1 horse 3 cattle	/	/
Gračanica (40)	17.02.1931	1 horse 4 cattle	1 horse 4 cattle	/	/
Bosanski Novi (41)	26.02.1931	0	0	0	0
Ključ (42)	01.01.1933	14 humans 4 horses 21 cattle 18 sheep	1 human 2 horses 21 cattle 18 sheep	19 horses 125 cattle 158 sheep	13 humans 2 horses
Drvar (43)	17.02.1933	5 cattle 12 sheep 5 goats	5 cattle 12 sheep 5 goats	/	/
Gradiška (44)	18.04.1933	/	/	1130 horses and cattle	0
Ključ (45)	21.04.1933	10 horses 65 cattle 52 sheep	7 horses 63 cattle 52 sheep	conducted	3 horses 2 cattle
Sanski Most (46)	27.04.1933	2 horses 42 cattle 6 sheep 2 swine	2 horses 23 cattle 6 sheep 2 swine	/	19 cattle
Bosanska Krupa (47)	27.4.1933.	/	/	4 horses 13 cattle	/
Cazin (48)	29.04.1933	6 horses 1 cattle	6 horses 1 cattle	/	/
Prijedor (49)	29.04.1933	/	/	148 horses and cattle	/
Banja Luka (50)	04.05.1933	3 cattle	3 cattle	/	/
Jajce (51)	13.05.1933	4 horses 12 cattle	4 horses 12 cattle	10 horses 150 cattle 180 sheep	0
Prnjavor (52)	15.05.1933	8 cattle 1 swine	8 cattle 1 swine	/	/
Dubica (53)	18.05.1933	Not present	0	Conducted	0

County	Date	Affected	Died	Vaccination	Cured
Ključ (54)	10.02.1937	22 horses 97cattle 204 sheep 15 goats	22 horses 97 cattle 204 sheep 15 goats	191 horses 4690 cattle 11310 sheep 397 goat 8 swine	/
Cazin (55)	10.03.1937.	4 horses 20 cattle	4 horses 20 cattle	60 horses 3319 cattle	/

The data from Table 2 come from the annual veterinary reports, but we must take into account that some of the county veterinarians, instead of numerical and quantitative epidemiological representation of livestock, used descriptive traits "present" or" conducted". The veterinarians also complain that the farmers hide the death of animals, or that they do not call veterinarians if suspicion of infectious disease exists. Farmers mostly bury animal carcasses without informing the official county veterinarian.

However, the greatest risk from transmission of anthrax from animals to humans was the fact that farmers persisted in their traditional beliefs to treat sick livestock. The most common way to threat sick cattle was bloodletting from jugular vein and ears – *Missio sanguinis*. Additionally, this was the probable reason why anthrax remained endemic in certain areas of the Vrbas Banate. Trumić (11) mentioned that besides vaccination, anthrax could wipe out entire herds leaving farmers without anything. From dead livestock, especially sheep, shepherds get some profits from processed wool or skin thus spreading the infection with anthrax bacillus to humans, which was widely known at the time. Thus, for example, shepherds used to make pelts from dead sheep skin, (local term was *kožun* or *kožuh*) which were later worn or sold. In cases when veterinarians destroyed affected herds of cattle and sheep flocks, full compensation was not paid to livestock breeders from the Banate. Furthermore, it happened that procedures for importing livestock were not fully regulated, and herds had to wait at customs stables for several days. It was common to have high mortality rates in those stables, which became a source of anthrax infection. Fairs and livestock markets were ideal places for spread of infections, but control in these places was on the highest level due to the Banate veterinarians' guidelines. Nevertheless, the livestock buyers had the habit to open cattle's mouth in order to check the animals' teeth to determine their age. This sometimes resulted in wounds on their hands forming high risk from developing cutaneous anthrax. Another problem for anthrax control was bad administration in the Banate. It took a long time to

get the approval for a veterinary investigation from the Banate veterinary service. Stray dogs and other carnivores ate remnants of dead animals and distributed spores of anthrax on pastures and populated areas.

During sending sampling material for analysis to Institute, in most cases local veterinarians did not take into care to enter anamnestic data in the referral or on what the sample should be tested for. This means that the additional problem was improper sampling of material. Another issue was that local veterinarians set up diagnosis according to clinical manifestation of the disease but without bacteriological confirmation. Considering the abovementioned atypical forms of anthrax, the rate of misdiagnosis in such cases was very high.

In some areas of the Banate, bones of dead animals were excavated without the knowledge of authorities or any supervision. These bones were sold for use in industry. If we take into account that it was not possible to determine whether these animals had died from anthrax or not, this can be the explanation for new cases of anthrax in humans where it was not possible to establish the source of infection. For such excavations, mainly homeless and gypsies were blamed.

Conclusion

Anthrax was prevalent infectious disease in the Vrbas Banate among domestic animals and humans. Contribution to anthrax prevention in animals was vaccination of livestock, which was very well accepted by the farmers. According to the authors, much better results in the control of anthrax could be achieved with intensive and systematic education of farmers and villagers from the Vrbas Banate, especially those from rural areas. Generally, this was a very difficult task because of a small number of educated veterinarians and advisory services at the time.

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Sažetak

Od 1929. do 1941. godine, Vrbaska Banovina bila je jedna od devet pokrajina Kraljevine Jugoslavije, a prema povijesnim podacima, najsiromašnija, bez dobro organizirane i održive poljoprivredne proizvodnje. Naturalistička proizvodnja i slaba kontrola zdravlja životinja u Vrbaskoj banovini su bili najvažniji čimbenici rizika širenja zaraznih bolesti. Bedrenica je bila vrlo rasprostranjena zarazna bolest domaćih životinja i čovjeka u tom razdoblju, ali neki podaci o ovoj bolesti ostali su rijetki. U ovom radu dat je pregled epidemiologije i kliničkih istraživanja bedrenice u Vrbaskoj banovini. Osim brojnih otežavajućih čimbenika koji su utjecali na kontrolu bedrenice, veterinarska služba Banovine doprinijela je razvoju stočarstva, zdravlja životinja i javnog zdravlja u tom razdoblju.

***Ključne riječi**: bedrenica; Vrbaska banovina; kontrola; povijest.*